

MEMORANDUM FOR THE RECORD

SUBJECT: Image Quality Evaluation Program

Introduction:

In anticipation of full committee action in prosecution of the Image Quality Evaluation Program, the Chairman and Vice-Chairman have prepared this memorandum to summarize the present status of the project, to indicate the sort of technical management they intend to impose, and to establish basic project philosophies.

This memorandum is primarily intended as a brief working paper for the participants of the program, to give them an idea of what is expected and to provide a frame of reference to aid in subsequent technical decisions. Further expansion of these considerations will be accomplished through committee meetings.

Basic Project Guideline:

It is vital to understand that the committee is expected to produce a suitable technique(s) for image quality evaluation. It is committed to two major areas of investigation: 1) edge-trace analysis, and 2) GEMS. The work statement, however, has been written with sufficient generality to permit examination of other means of evaluation; should the first two prove infeasible to implement or inaccurate (or unreliable) to use. The emphasis must be placed on these two techniques - all else is secondary, and programs diverging from this line must be suitably justified if they fail to support the main effort.

Security Status:

The program is to be carried out on an unclassified basis, although contractual arrangements will be made on a sponsor-sterile basis, at the Confidential level. The existence of the committee, in relation to the sponsor, is definitely not to be made known to anyone not properly cleared for such information. Publication of results, theoretical studies, and the like, after suitable security review, is encouraged. All manuscripts should be submitted to the Chairman for appropriate security approval.

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Program Summary:

A rough narrative description of the proposed program follows. This is a condensation and combination of all the submitted proposals, and summarizes the cited participants' current interests. The degree of participation in any or all of the various aspects could change as the program progresses. The Chairman will have the responsibility to authorize a change in direction, should this be necessary later on in the program. All the possible ramifications of the basic problem appear to be amply covered.

Perkin-Elmer will be working on GEMS, the designing and testing of which will be aided by Dr. Buckner (Human Factors Research, Inc.). A study on some of the subjective aspects of the problem is presently under way by this team. The results of these studies will be made available to the committee, and should prove invaluable. Itek's work on GEMS will be carried out under another program, the results of which will also be available to the committee.

Edge-trace studies will be carried out by three participants (Itek, Perkin-Elmer, Data Corporation), with additional data (in the form of detailed mission analyses) furnished by Eastman Kodak and SPPL, through [redacted]. All the firms engaged in edge-trace analysis will be concerned with investigating this technique with an eye to its ultimate implementation. They will study its fundamental accuracy and reproducibility, and attempt to parametrize the various sources of error, so that a complete understanding of the method and its limitations may be established. Its practicality for large-scale operation may then be properly assessed. 50X1

NBS (Mr. McCamy) will contribute a side-study on scanning photomicrographs of edges and analyzing them through computer techniques. This exploits a promising method developed at NBS for metallurgical analysis. Itek will undertake a study on analyzing photographic edges through a split-field microscope in much the same manner as the comparative GEMS judgements are made. [redacted] will contribute a study on the analysis of photographic edges through coherent optical techniques. 50X1

NBS will be responsible for providing physical standards to be used in calibrating microdensitometers. These will consist of specially prepared edges, one-dimensional sine-waves (linear in optical transmission), and a technique for specifying density. So that all results may be properly related, it will be necessary to standardize procedures and know the relevant transfer functions of the measuring equipment. The standardization problems will be covered in detail in the initial meetings, and subsequently in visits by NBS personnel.

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The Data Corporation will contribute studies on grain noise and how its effect on edge measurements may be minimized. The handling of data, through computers, will also be studied, particularly the smoothing problem. They will also consider measuring apertures, with the expectation of specifying an optimum shape and size. Data Corporation will also study the problem of determining the appropriate edges to trace.

Human Factors Research is not contributing in the form of a specifically proposed task, but will make its main efforts in concert with the entire group, by helping plan the psychometric aspects of testing and evaluation. In addition, much of the data which has and will continue to accumulate requires analysis through statistical processes. Human Factors will provide assistance in this necessary correlation of the data, and in many instances carry out the statistical analysis. It is expected that this will reveal the significant parameters in terms of meaningful statistical measures.

Eastman Kodak will be represented on the committee, but has proposed no program. Since they already are working on several aspects of the edge-trace problem through other current contracts, it was felt that additional programs would be redundant. They will continue to advise on matters of film characteristics and processing, as they did for the Drell committee, and the results of the concurrent programs will be available to the committee.

The Technical Advisor, Dr. James Eyer, of the Institute of Optics, University of Rochester, will consider the problem of characterizing image quality in terms of the objective and subjective measurements, and will summarize the current state of technology at the initial meeting if possible. He will be available for consultation to the committee on all matters relating to this problem area.

Initial Committee Meeting:

An initial meeting will be held in Washington, D. C. on 13, 14, 15 July, 1964 for the purpose of orientation and detailed discussions of the problem. At this meeting an attempt will be made to establish a basic working philosophy, with respect to the desired solution of the problem at hand. The members of the committee will be asked to present their views on the problem, together with a preliminary outline of the program they have proposed. These presentations will be as complete as possible to provide the committee with a full picture of each member's intended contribution. This is intended to encourage mutual assistance between

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members on areas of interest and contractual overlap. In all cases, contractual overlap has been deliberately sought because of the advantage of differing approach to the problem. Additionally, some of the committee members can serve best by making many small side-contributions to the major efforts, clarifying and sorting out some of the subtleties which make precision difficult. It will require a spirit of cooperation based on mutual interest in bringing all possible capabilities to bear on solving this problem. It is hoped that this and subsequent meetings will engender such a cooperative spirit.

Once all the proposed programs have been presented and discussed, it is quite possible that some of the members' work statements could or should be revised to include material and ideas brought out in the discussions, or to specifically call out working relationships between some of the members on particular sub-problems. Time will be allowed for such consultation and revisions as are deemed necessary, and secretarial help provided. The committee, before adjourning, will issue a summary of the entire program, with the specific tasks called out, the responsibilities, and the member inter-relationships noted.

Monthly Reports:

Participants will be expected to submit monthly letter reports to the Chairman. They shall be as detailed as necessary to indicate the extent of progress. From these reports a project summary will be prepared by the Chairman for transmission to all committee members, and will constitute the official progress statement of the committee. This will be issued in the form of a Newsletter which will have no formal structure.

Project Visits:


To supplement the monthly reports, periodic visits will be made by the Chairman and/or the Vice-Chairman to observe and discuss project progress. These visits will be made as deemed necessary, and not on a regularly scheduled basis. Frequent visits between committee members are encouraged, and should be noted in the monthly letter reports.

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Subsequent Meetings:

As the need arises for additional meetings, they shall be called. There will be at least two more meetings after the initial one. One will be held roughly half-way through the program, or at some point where a major project decision must be made. Here the committee can take stock, discuss project progress, consider re-orientation, or take whatever steps that appear necessary. The other meeting will most likely be held at the end of the program, at which time the results will be evaluated and a final report issued.

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Chairman, Image Quality
Evaluation Program